

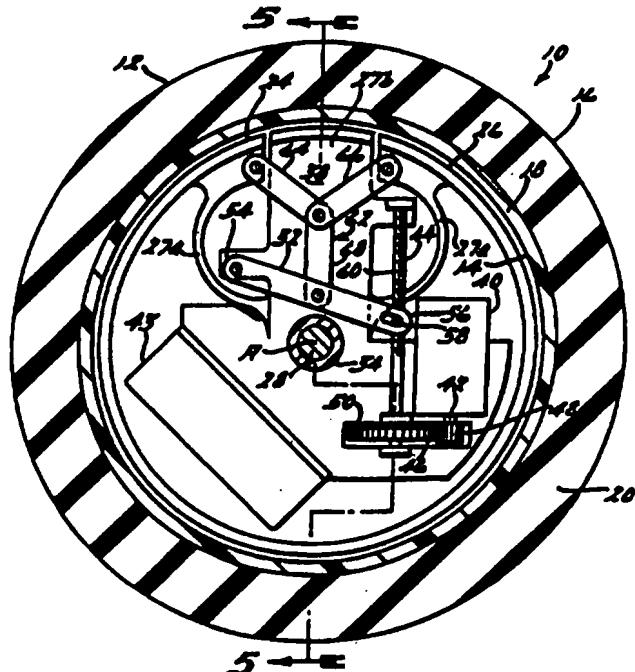


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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**(54) Title: ANTI-THEFT VEHICLE SYSTEM****(57) Abstract**

An anti-theft vehicle system (10) for a vehicle wheel (12) having a rotational axis (A) includes at least one inhibitor (24, 26) disposed within the vehicle wheel to selectively engage the vehicle wheel to prevent the vehicle wheel from rotating about its rotational axis. The anti-theft vehicle system also includes rotatable means (44, 46) disposed within the vehicle wheel and cooperating with the inhibitor for moving the inhibitor between an engaged position and a disengaged position with the vehicle wheel.



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ANTI-THEFT VEHICLE SYSTEMBACKGROUND OF THE INVENTION1. Field Of the Invention

5 The present invention relates generally to vehicles and, more particularly, to an anti-theft vehicle system used to inhibit rotation of a vehicle wheel outside a predetermined spatial perimeter.

2. Description Of the Related Art

10 It is sometimes desired to contain a vehicle within a predetermined spatial boundary or perimeter. In particular, retail stores are attempting to reduce the amount of lost vehicles such as shopping carts, which are either stolen or taken out of the normal bounds of the stores and not returned.

15 Accordingly, United States Patent No. 5,194,844 to Zelda discloses a vehicle theft prevention system which inhibits the use of a shopping cart once it is moved outside a boundary. This patented system includes an electronic wire that extends around and defines a perimeter of normal operating space which is used by operators of a store's shopping carts. The 20 electronic wire produces an electromagnetic field which is sensed by a sensor located adjacent one wheel of the shopping cart. The sensor sends a signal to a motor which moves a brake pad against the wheel of the shopping cart. Two limit switches are used to stop the motor when the motor has either moved the 25 brake pad into or out of engagement with the wheel of the shopping cart.

30 One disadvantage of the above system is that it is relatively expensive because the motor must be large and two limit switches are needed. Another disadvantage of the above system is that an asymmetric time-variant wave form is used for the electromagnetic field which is undesired.

SUMMARY OF THE INVENTION

It is, therefore, one object of the present invention to provide an anti-theft vehicle system for vehicles.

It is another object of the present invention to provide an anti-theft vehicle system for vehicles such as shopping carts, toys, wheeled inventory, and industrial forklifts.

5 It is yet another object of the present invention to provide an anti-theft vehicle system for a vehicle wheel to prevent an operator from moving the vehicle outside a predetermined spatial perimeter.

10 It is still another object of the present invention to provide an anti-theft vehicle system for a shopping cart wheel which is inexpensive and effective at making it difficult for an operator to move the shopping cart out of a predetermined operating area of a retail store.

15 To achieve the foregoing objects, the present invention is an anti-theft vehicle system for a vehicle wheel having a rotational axis. The anti-theft vehicle system includes at least one inhibitor disposed within the vehicle wheel to selectively engage the vehicle wheel to prevent the vehicle wheel from rotating about its rotational axis. The 20 anti-theft vehicle system also includes rotatable means disposed within the vehicle wheel and cooperating with the inhibitor for moving the inhibitor between an engaged position and a disengaged position with the vehicle wheel.

25 One advantage of the present invention is that an anti-theft vehicle system is provided for vehicles such as shopping carts, toys, wheeled inventory, and industrial forklifts. Another advantage of the present invention is that the anti-theft vehicle system provides a vehicle wheel which deters an operator from moving the vehicle outside a 30 predetermined spatial perimeter. Yet another advantage of the present invention is that the anti-theft vehicle system provides a cost effective vehicle wheel to deter operators from taking shopping carts out of a retail store's shopping cart boundary by preventing the vehicle wheel from rotating. Still another 35 advantage of the present invention is that the anti-theft vehicle system provides a one-piece brake, springs and component mounting area for the vehicle wheel. A further advantage of the

present invention is that the anti-theft vehicle system is self-energizing in both directions. Yet a further advantage of the present invention is that the anti-theft vehicle system provides a linkage overrun for position lock of the vehicle wheel. Still 5 a further advantage of the present invention is that the anti-theft vehicle system changes the angle of a thrust arm to maximize brake linkage efficiency.

10 Other objects, features and advantages of the present invention will be readily appreciated as the same becomes better understood after reading the subsequent description when considered in connection with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

15 FIG. 1 is a perspective view of a anti-theft vehicle system, according to the present invention, illustrated in operational relationship with vehicles and a predetermined spatial perimeter.

FIG. 2 is a perspective view of a vehicle and the anti-theft vehicle system of FIG. 1.

20 FIG. 3 is an exploded view of a wheel of the vehicle and the anti-theft vehicle system of FIG. 2.

FIG. 4 is a sectional view taken along line 4-4 of FIG. 3.

FIG. 5 is a sectional view taken along line 5-5 of FIG. 4.

25 FIG. 6 is a schematic view of a control circuit of the anti-theft vehicle system of FIGS. 1 through 3.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

Referring to FIG. 1, one embodiment of an anti-theft vehicle system 10, according to the present invention, is shown 30 in operational relationship with vehicles inside a predetermined spatial boundary. In one embodiment, the system 10 is used to prevent theft of vehicles such as shopping carts 22 from a predetermined spatial boundary or perimeter 11a of a retail store 11b. It should be appreciated that the system 10 may be 35 used on other vehicles such as toys, wheeled inventory,

industrial forklifts to prevent the same from exiting a predetermined spatial boundary.

As illustrated in FIGS. 2 through 5, the system 10 includes at least one wheel 12 for the vehicle embodiment of a shopping cart 22. The wheel 12 has an inner diameter 14 and an outer diameter 16 and a rotational axis A about which the wheel 12 rotates. The wheel 12 also has a housing or hub 18 and a surface engaging member 20. The surface engaging member 20 is made of a suitable material such as a plastic material. Preferably, the plastic material is a urethane material. The hub 18 may be fabricated from the same material as the surface engaging member 20. Preferably, the hub 18 is made of a plastic material such as ABS and secured to the surface engaging member 20.

The system 10 also includes at least one inhibitor 24 disposed within the wheel 12 to selectively engage the wheel 12 and prevent the wheel 12 from rotating about its rotational axis A. The inhibitor 24 is a partial cylindrical shaped brake pad which is forced against the inner diameter 14 or hub 18 of the wheel 12. In one embodiment, a second inhibitor 26 is disposed within the wheel 12 to selectively engage another portion of the hub 18 of the wheel 12. The second inhibitor 26 is also a partial cylindrical shaped brake pad which is forced against the inner diameter 14 of the wheel 12. The inhibitors 24, 26 are integral and made of one-piece. The inhibitors 24, 26 are fabricated from a plastic material, such as a glass reinforced nylon material, which has a memory quality to maintain the shape of the inhibitors 24, 26. The inhibitors 24, 26 have a spring 27a connected to an extension 27b which acts as a component mounting area. The memory quality of the plastic material for the springs 27a creates a spring-like force predisposing the inhibitors 24, 26 to disengage the wheel 12. It should be appreciated that the inhibitors 24, 26, springs 27a and extension 27b are fabricated as one-piece from the same material.

The system 10 further includes an axle pin or shaft 28 which acts as the rotational axis A for the wheel 12. The shaft

28 is made of a metal material such as steel. The system 10 also includes two waterproof bearings 30 and yoke lock plates 32 supported by the shaft 28. The yoke lock plates 32 have internal notches 33 which engage an axle 34 and prevent the axle 34, which rides along the shaft 28, from rotating. The yoke lock plates 32 also include tabs 36 which prevent the waterproof bearings 30 from rotating.

The system 10 includes an axle arm 38 securely mounted such as by welding about the axle 34. The axle arm 38 is a plate made of a metal material such as steel. The extension 27b is connected to the axle arm 38 by suitable means such as an adhesive. The system 10 also includes a motor 40 such as an electric motor mounted to the extension 27b of the inhibitors 24, 26 between the rotational axis A and the inner diameter 14. The motor 40 provides rotational movement independent of the movement of the wheel 12 along an axis defined by a motor shaft 42. The motor 40 receives power from a power source such as a battery 43 which is electrically connected to both the motor 40 and a wheel controller 72 to be described. It should be appreciated that the battery 43 is attached to the extension 27b of the inhibitors 24, 26 by suitable means.

The system 10 further includes a screw or worm gear 44 rotated by the motor 40 through a gear drive 46. The gear drive 46 allows the motor 40 to be placed along side the worm gear 44, conserving space, and reduces the rotational speed of the worm gear 44. More specifically, the gear drive 46 includes a first gear 48 and a second gear 50 such that the second gear 50 has a larger diameter than the first gear 48. The first gear 48 is secured to the motor shaft 42 and rotates at a faster rate than the second gear 50 which is driven by the first gear 48. It should be appreciated that the gear drive 46 may use any number of gears and gear sizes depending on the size and motor speed requirements.

The system 10 also includes a drive arm or lever 52 connected to the inhibitors 24, 26. The lever 52 has a pivotal end 54 and a gear engaging end 56. The gear engaging end 56 receives the worm gear 44 and moves along the worm gear 44 as

the worm gear 44 is rotated. The gear engaging end 56 includes a nut 58 for receiving the worm gear 44 therein and rides along the worm gear 44 as the nut 58 receives the threads 60 of the worm gear 44.

5 The lever 52 pivots about a pivot end 54 which is pivotally secured to the extension 27b of the inhibitors 24, 26. When the lever 52 pivots about the pivot end 54, the inhibitors 24, 26 and the wheel 12 engage to prevent the rotational movement of the wheel 12. If, however, the inhibitors 24, 26  
10 are all ready engaging the wheel 12, the motor 40 will reverse to pivot the lever 52 back toward the motor 40 to disengage the inhibitors 24, 26 from the wheel 12, allowing the wheel 12 to rotate along with the other wheels of the shopping cart 22.

15 The system 10 also includes a linkage, generally indicated at 62, to connect the inhibitors 24, 26 to the lever 52. The linkage 62 is connected to the lever 52 between the pivotal end 54 and the gear engaging end 56. The linkage 62 includes a first thrust arm or link 64 and a second thrust arm or link 66 which are pivotally moveable with respect to each  
20 other. The first and second links 64 and 66 are pivotally secured to each of the first and second inhibitors, 24 and 26, respectively.

25 The linkage 62 further includes a transfer arm or principle link 68 which is pivotally secured to the first and second links 64 and 66 and the lever 52. The movement allowed by the principle link 68 forces the first and second links 64 and 66 to move in opposite directions. When the two links 64, 66 move in opposite directions, the first and second inhibitors 24, 26 move in opposite directions, either into engagement or  
30 disengagement with the hub 18 of the wheel 12. Although not necessary, the first and second links 64 and 66 are identical in shape and move not only in opposite directions but with equal magnitude. Further, the cost of the system 10 is further reduced by having the first, second and principle links 64, 66 and 68 fabricated to the same shape and size. This reduces the  
35 cost of the system 10 further by reducing parts.

Referring to FIG. 6, the anti-theft vehicle system 10 includes a control circuit generally shown at 69, for the system 10. The control circuit 69 is a circuit board overlay which is disposed within the hub 18 of the wheel 12. The control circuit 69 includes a receiver 70 for receiving a signal to activate the motor 40 to move the inhibitors 24, 26 such that the inhibitors 24, 26 either engage or disengage the wheel 12. Preferably, the receiver 70 is an antenna which receives a signal such as an RF signal created by a signal generator 74 to be described.

The control circuit 69 also includes a wheel controller 72 which receives the signal from the antenna 70 and is electrically connected between the antenna 70 and the motor 40. The wheel controller 72 selectively activates the motor 40 based on perimeter parameters received from the antenna 70. The perimeter parameters are created by a signal generator 74 and buried wire cable 76 to be described and illustrated in FIG. 1.

The wheel controller 72 includes a tuned receiver 78 which receives the signals from the antenna 70 and a tone decoder 80. The tuned receiver 78 amplifies the signal and sends it to the tone decoder 80 for decoding the perimeter parameters signal. The wheel controller 72 also includes a flip flop retrieval deactivation circuit 82 and a motor controller timer 84 which receives the signal once it has been decoded. The flip flop retrieval deactivation circuit 82 determines which direction the motor 40 is to rotate the motor shaft 42. More specifically, the flip flop retrieval deactivation circuit 82 will signal the motor controller timer 84 to operate the motor 40 dependent upon the input received by the flip flop retrieval deactivation circuit 82 and the tone decoder 80. The wheel controller 72 includes a the master timer 86 which receives input from a rotation sensor 88 such as a magnet of the control circuit 69.

For example, the flip flop retrieval deactivation circuit 82 receives input from the tuned receiver 78 stating the location of the shopping cart 22 has changed such that the shopping cart 22 has passed over the buried wire cable 76 signifying that the shopping cart 22 has passed either into or

out of the perimeter parameters defined by the buried wire cable 76. The flip flop retrieval deactivation circuit 82 then determines whether the shopping cart 22 was inside or outside the buried wire cable 76 by determining whether the wheel 12 was 5 rotating. From the rotation sensor 88, determination of the rotation of the wheel 12 will determine whether the shopping cart 22 was inside or outside of the buried wire cable 76. If the rotation sensor 88 receives no signal, the wheel 12 is not 10 rotating and is already locked. Therefore, receiving a signal from the tuned receiver 78 will indicate that the shopping cart 22 has passed back into the perimeter of the allowed area for 15 the shopping cart 22 to operate. The rotational state of the wheel 12 goes from a non-rotating state to a rotating state. If, however, the flip flop retrieval deactivation circuit 82 receives a signal from the tuned receiver 78 when the rotation 20 sensor 88 is sending a signal indicating that the wheel 12 is rotating, it will be determined that the shopping cart 22 has moved to a location outside of the perimeter defined by the buried wire cable 76 and will turn the motor 40 such that the inhibitors 24, 26 will abut the wheel hub 18 preventing the 25 wheel 12 from rotating. Thus, the rotational state of the wheel has gone from a rotating state to a non-rotating state.

The signal generator 74, shown in FIG. 1, generates a square wave output having a low frequency cycle between 60Hz and 1kHz which is sent along the buried wire cable 76 and defines 25 the area in which the shopping cart may operate. The signal generator 74 may be any type of signal generator suitable to produce a signal which will pass along the entire length of the buried wire cable 76.

30 The present invention has been described in an illustrative manner. It is to be understood that the terminology which has been used is intended to be in the nature of words of description rather than of limitation.

Many modifications and variations of the present 35 invention are possible in light of the above teachings. Therefore, within the scope of the appended claims, the present

invention may be practiced otherwise than as specifically described.

WHAT IS CLAIMED IS:

1. An anti-theft vehicle system for a vehicle wheel having a rotational axis comprising:

5       at least one inhibitor disposed within the vehicle wheel to selectively engage the vehicle wheel to prevent the vehicle wheel from rotating about the rotational axis; and

10       rotatable means disposed within the vehicle wheel and cooperating with said at least one inhibitor for moving said at least one inhibitor between an engaged position and a disengaged position with the vehicle wheel.

2. An anti-theft vehicle system as set forth in claim 1 including a motor mounted between said rotational axis and an inner diameter of the vehicle wheel.

15       3. An anti-theft vehicle system as set forth in claim 2 including a worm gear rotatable by said motor.

20       4. An anti-theft vehicle system as set forth in claim 3 including a lever connected to said at least one inhibitor and having a pivotal end and a gear engaging end, said gear engaging end receiving said worm gear and moving therealong when said worm gear receives rotational movement from said motor, said lever pivoting about said pivot end to engage said at least one inhibitor with the wheel to prevent the rotational movement thereof.

25       5. An anti-theft vehicle system as set forth in claim 4 including a linkage connecting said at least one inhibitor to said lever.

6. An anti-theft vehicle system as set forth in claim 5 wherein said linkage is connected to said lever between said pivotal end and said gear engaging end.

7.. An anti-theft vehicle system as set forth in claim 4 wherein said linkage including first and second links pivotally moveable with respect to each other.

5 8. An anti-theft vehicle system as set forth in claim 7 wherein said linkage further including a principle link pivotally securing said first and second links to said lever such that movement of said principle link forces said first and second links to move in opposite directions.

10 9. An anti-theft vehicle system as set forth in claim 2 including a receiver for receiving a signal to activate said motor to move said at least one inhibitor such that said at least one inhibitor engages the wheel.

15 10. An anti-theft vehicle system as set forth in claim 4 wherein said gear engaging end including a nut for receiving said worm gear therein and for moving along said worm gear as said worm gear rotates.

11. An anti-theft vehicle system for a vehicle comprising:

20 a wheel defining inner and outer diameters and a rotational axis, said wheel including a hub and a ground engaging surface;

at least one inhibitor selectively engageable with said wheel to prevent said wheel from rotating about said rotational axis;

25 a motor mounted between said rotational axis and said inner diameter, said a motor providing rotational movement;

a worm gear rotatable by said a motor;

30 a lever connected to said inhibitor defining a pivotal end in a gear engaging end, said gear engaging end receiving said worm gear and moving therealong when said worm gear receives said rotational movement from said motor, said lever pivoting about said pivot end to engage said at least one

inhibitor with said wheel to prevent rotational movement thereof;

a control system for creating perimeter parameters defining a perimeter;

5 a transmitter electrically connected to said control system for transmitting said perimeter parameters; and

an antenna fixedly secured to said wheel for receiving said perimeter parameters.

10 12. An anti-theft vehicle system as set forth in claim 11 including a wheel controller electrically connected between said antenna and said motor for selectively activating said motor based on said perimeter parameters received from said antenna.

15 13. An anti-theft vehicle system as set forth in claim 11 including a rotational sensor for sensing rotation of said wheel.

14. An anti-theft vehicle system as set forth in claim 13 wherein said rotational sensor includes a magnet attached to said wheel.

20 15. An anti-theft vehicle system as set forth in claim 11 including a tone decoder array for decoding said perimeter parameters.

25 16. An anti-theft vehicle system as set forth in claim 11 including a retrieval deactivation circuit, said retrieval deactivation circuit determining if the vehicle is entering or exiting said perimeter.

17. An anti-theft vehicle system as set forth in claim 11 including a receiver for receiving signals from said antenna and for amplifying the signals.

18. An anti-theft vehicle system as set forth in claim 11 including a linkage connecting said at least one inhibitor to said lever.

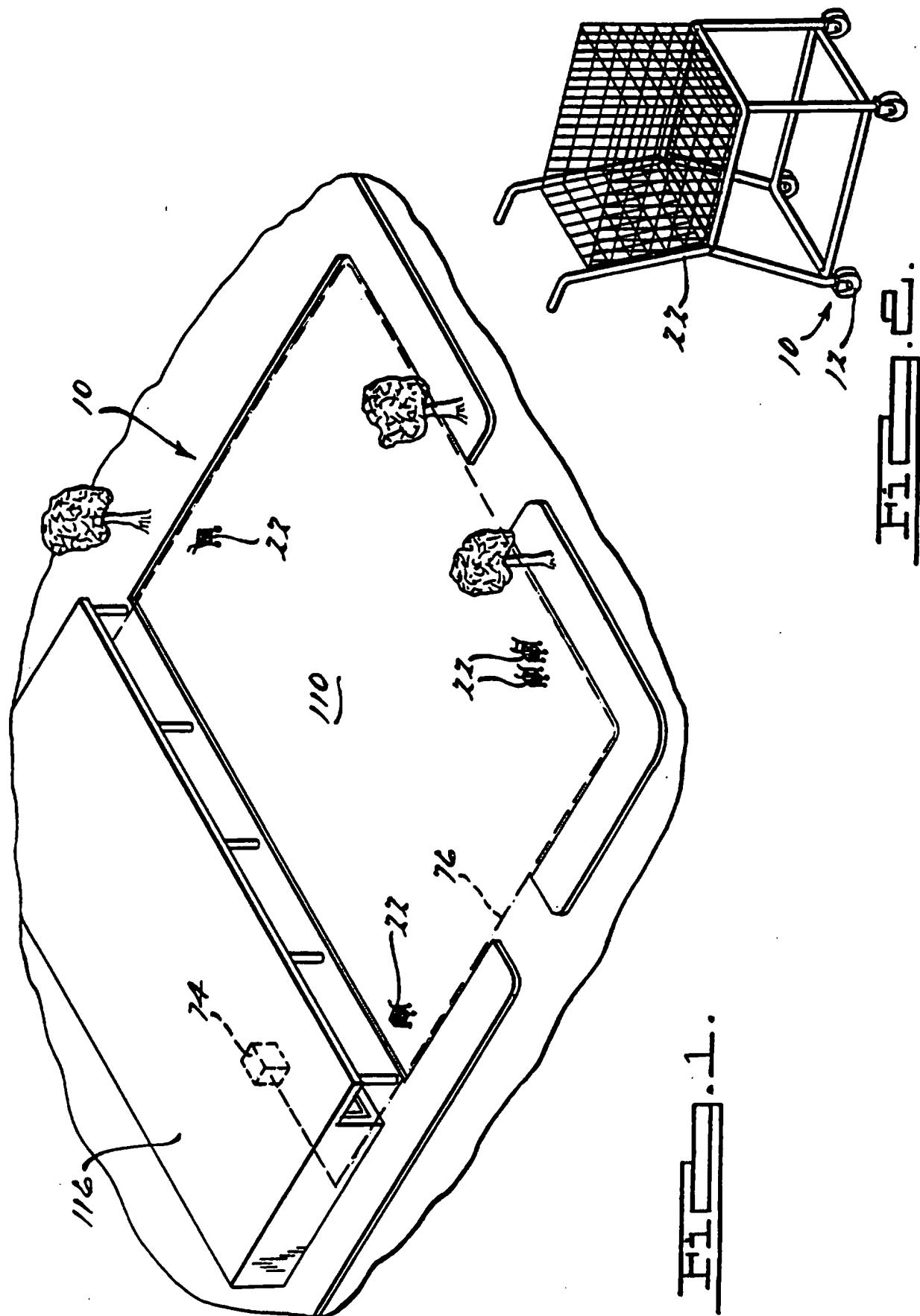
5 19. An anti-theft vehicle system as set forth in claim 18 wherein said linkage being rotatably secured to said lever between said pivotal end and said gear engaging end.

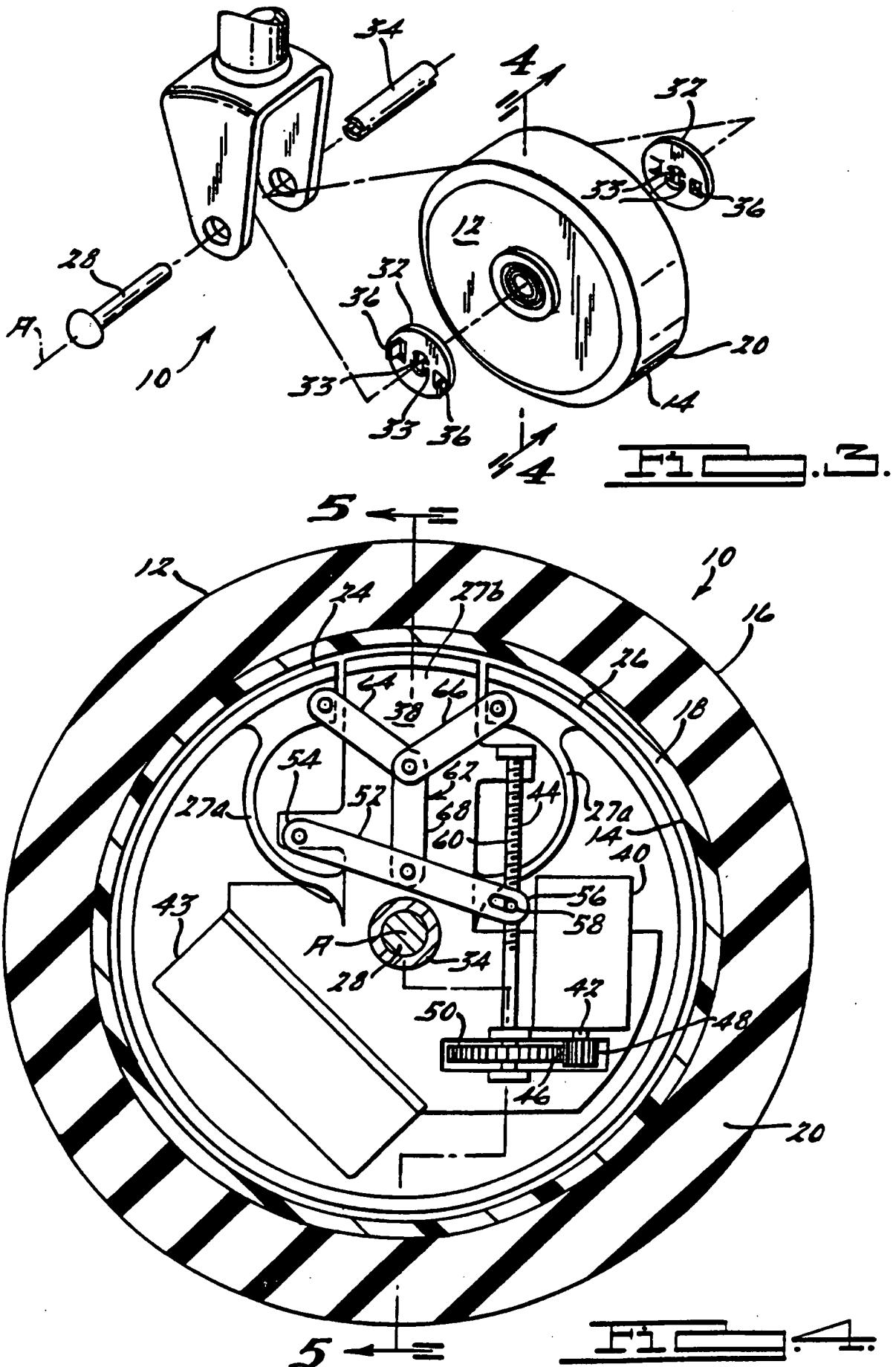
20. An anti-theft vehicle system as set forth in claim 19 wherein said linkage including first and second links pivotally moveable with respect to each other.

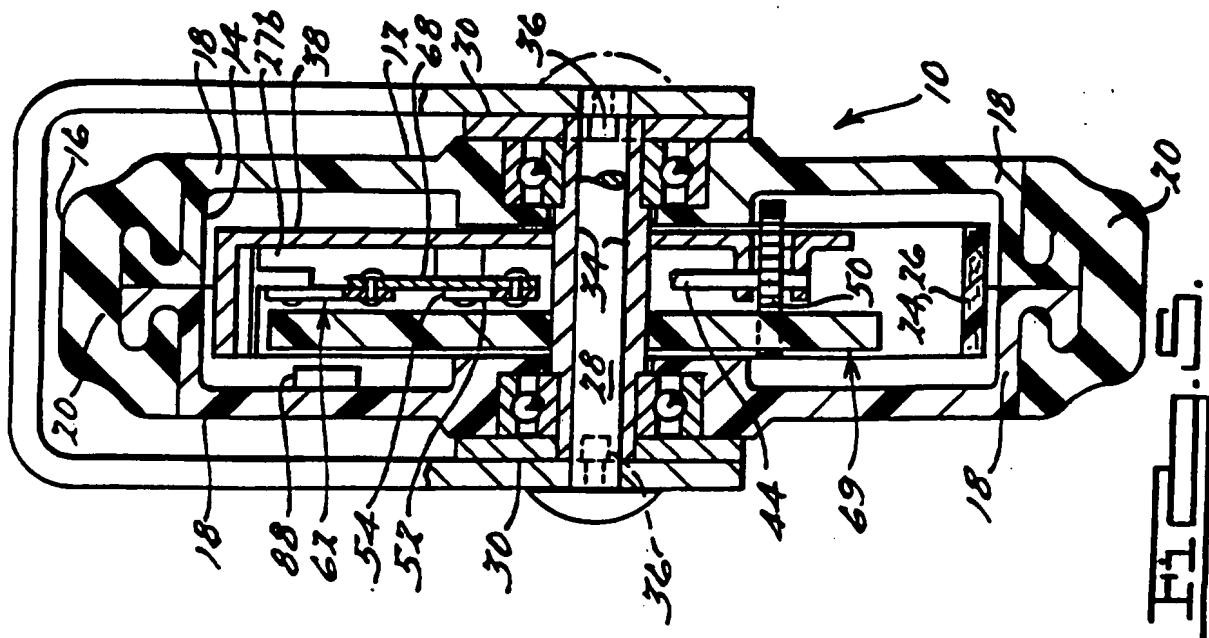
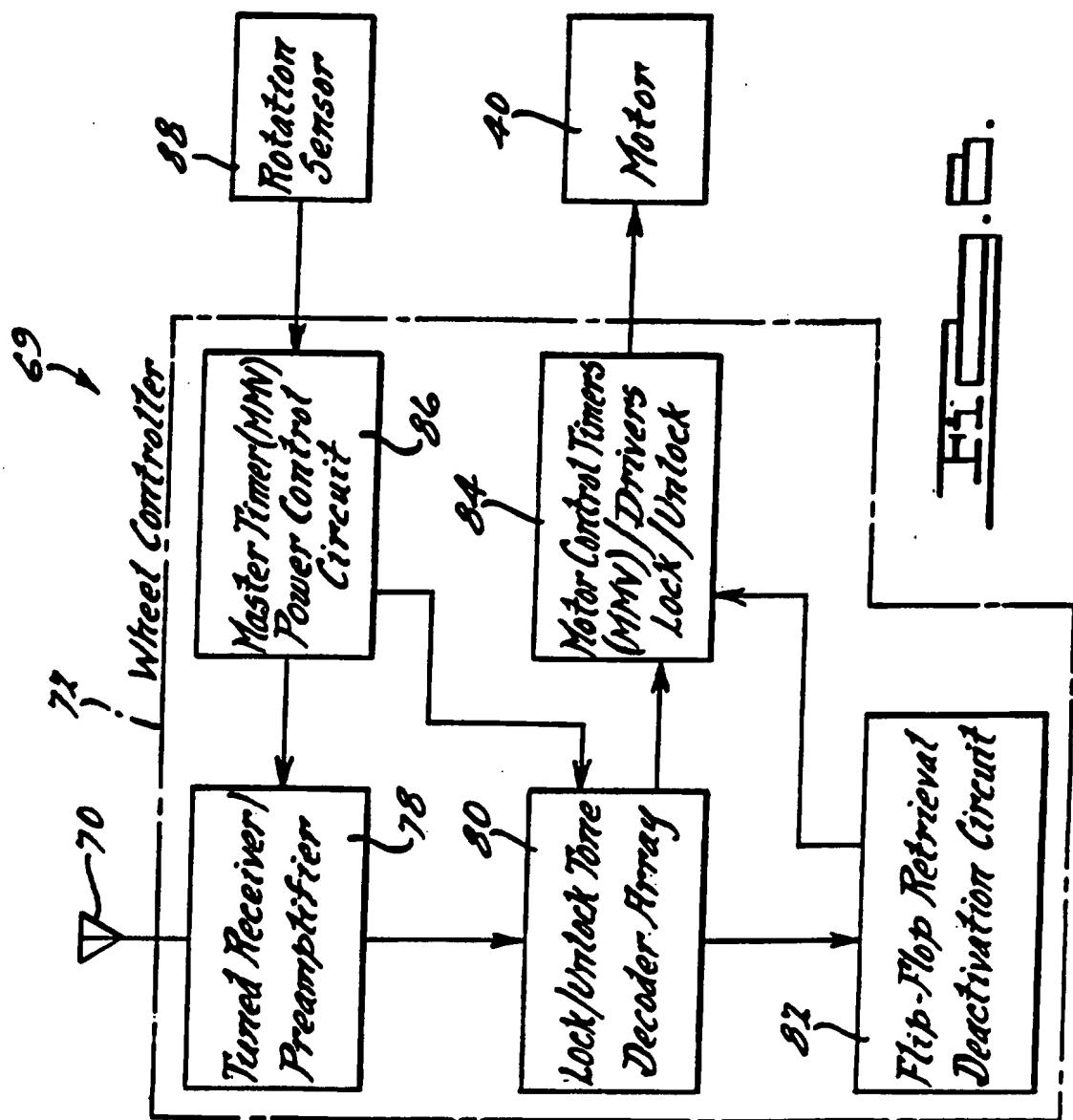
10 21. An anti-theft vehicle system as set forth in claim 20 wherein said linkage further including a principle link pivotally securing said first and second links to said lever such that movement of said principle links forces said first and second links to move in opposite directions.

15 22. A method of positioning an inhibitor associated with a wheel of a vehicle, the method comprising the steps of:  
receiving a signal determining location of the vehicle;

20 determining whether the wheel is rotating; and  
moving the inhibitor to a position based on the location and rotation of the wheel such that the inhibitor will change the rotation of the wheel between rotating and non-rotating states.







## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US95/16925

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :G08B 13/14

US CL :340/568; 188/111; 280/33.994

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 340/568,539,426,933,935; 188/111,162; 280/33.994; 180/167; 307/10.2; 70/226,228; 455/345

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS (shopping cart, brake, disable, immobilize, prevent rotation)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 5,000,297 (SHAW ET AL.) 19 March 1991. See Figs. 1-4 and col. 1, lines 52-55.	1-3,9
X	US, A, 4,809,824 (FARGIER ET AL.) 07 March 1989. See Figs. 2-4.	1-3,9
X	US, A, 3,809,191 (WOODWARD) 07 May 1974. See Fig. 12, col. 3, line 65 and col. 6, lines 45-52.	1-6,10
X	US, A, 5,315,290 (MORENO ET AL.) 24 May 1994. See Figs. 1 and 6 and col. 4, lines 31-43 and 54-61.	22
X	US, A, 5,194,844 (ZELDA) 16 March 1993. See Figs. 1 and 4, col. 5, lines 17-39 and col. 6, line 49 to col. 7, line 37.	22

Further documents are listed in the continuation of Box C.

See patent family annex.

•	Special categories of cited documents:	
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